



### Product Features

The complementary metal-oxide semiconductor (CMOS) integrated circuit acted as a catalyst for the development of Epson's\* semiconductor business. Development work on a watch IC began in earnest when Epson committed itself to the internal development of chips for the Seiko Quartz Astron 35SQ. Requiring little power and able to make the products in which they are used both smaller and cheaper, CMOS ICs would go on to play a major role in the later evolution of the quartz watch.

ICs are broadly classified as either MOS or bipolar, depending on the structure of the transistors they contain. Although slower than bipolar circuits, MOS circuits consume less power and allow for higher integration densities. Recognizing the importance of these MOS features, Epson resolved to concentrate on developing a particularly low-power-consuming type of MOS circuit known as a CMOS circuit.

Research and development bore fruit in 1971, when Epson developed the first CMOS chip for an analog quartz watch, the Seiko Quartz V.F.A. 38SQW. The chip had a footprint of slightly less than 5 square millimeters and was equipped with a frequency-divider and a function for outputting signal waveforms that drove a stepping motor. The following year, development teams came up with a CMOS IC for a digital quartz watch called the Seiko Quartz LC V.F.A. 06LC.

### Background

The tabletop-sized Seiko Crystal Chronometer QC-951, whose development was announced in 1963, was the earliest portable quartz timepiece. Shrinking this timepiece down to wristwatch size required an intensive development effort to scale down the size of the main parts, decrease power consumption, and improve reliability. The development of a low-power IC was recognized as the key to solving these problems.

At the time, no semiconductor manufacturer was producing ICs for quartz watches. Epson therefore had to rely on its own ingenuity for developing ICs. In 1969, at the end of a protracted research and development effort, the company succeeded in developing the Seiko Quartz Astron 35SQ, a watch with an Epson hybrid IC. Recognizing during volume production of the 35SQ that ICs were one of the key components of the future, the company resolved to develop and volume-produce its own CMOS ICs, and officially launched the MOS IC Development Project.

In 1971, the company succeeded in developing its own CMOS ICs. In 1973, Epson completed a fabrication facility and put together an organization for the internal development and production of CMOS ICs.

### Impact

The CMOS IC successfully developed in 1971 was used in the company's quartz watches. These semiconductor chips went on to grow and develop along with the expansion of the watch business. In 1976 the Semiconductor Operations Division, which was made up of manufacturing, engineering, and design organizations, was officially launched to expand Epson's semiconductor business.

The Semiconductor Operations Division began supplying watch ICs to the Seiko Group in about 1973, marking Epson's first sales of CMOS ICs outside the company. Then, in 1978, Epson began selling melody ICs and digital watch ICs. Epson's current semiconductor business grew along with the product line, which went on to encompass generic memory, as well as voice synthesizer chips, gate arrays, ASICs and a host of other ICs for industrial and consumer applications.

\*Then known as Suwa Seikosha Co., Ltd.